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EXAMINER	
ARTMAN, THOMAS R	
ART UNIT	**PAPER NUMBER**
2882	

DATE MAILED: 06/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/903,999	HASEGAWA, TOMIICHI	
	Examiner	Art Unit	
	Thomas R Artman	2882	

-- The MAILING DATE of this communication appears on the cover sheet with th c rrespondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _18 April 2003_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-15_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-15_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _8_.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Information Disclosure Statement

The information disclosure statement, filed April 18th, 2003, has been entered and considered by the examiner. The objection made in the previous Office action has been successfully answered by this filing.

Claim Objections

The claim objections made in the previous Office action have been successfully remedied by the applicant's amendments.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 7 is rejected under 35 U.S.C. 102(b) as being anticipated by Martin (US 5,712,704).

Martin discloses all of the structure in is anisotropy measurement device (Fig.1), including:

1) preparing a single polarized light beam (item 21),

2) introducing the single polarized light beam into a sample to be measured (item 2),

3) dividing the single polarized light beam into two light beams after passing through the sample (item 12),

4) superimposing the two divided light beams (item 12), and

5) observing an interference pattern of the thus obtained superimposed light beam (item 3).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-6 and 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gutierrez (US 5,706,084) and in view of Yeh (EPO 209,721).

Regarding claims 8 and 11, Gutierrez teaches a standard arrangement for anisotropy analysis with beams superimposed through the sample generally shown in Fig.1 and described in col.6, lines 44-65, including:

before a sample to be measured in anisotropy:

1) a laser source to generate and oscillate a light beam to be used in anisotropy analysis (item 22),

2) a light polarizing means (item 26) that separates the light into two orthogonally polarized light beams, and,

after the sample to be measured in anisotropy,

3) a light beam analyzing means (item 32) that superimposes the two light beams with corresponding planes of polarization in order to produce interference, and

4) a detector for observing the resulting interference pattern.

Gutierrez does not specifically teach physically splitting the beams prior to polarization rotation and recombining them before the sample, or the reverse process of physically splitting

the beams, rotating polarization of one of the beams and then recombining the beams after the sample.

Yeh teaches of an equal path Mach-Zehnder arrangement (Fig.1) for splitting the superimposed orthogonally polarized beam from a sample being measured in anisotropy using a polarizing beam splitter (item 24), rotating the polarization state of one beam relative to the other using a half-wave plate (item 30), and recombining them using a half-mirror in order to produce an interference pattern (item 38) that is projected onto a detector (item 40). This structure takes advantage of having a high tolerance for noise through common-mode rejection and can be made quite small (p.2, Summary, 1st par.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yeh's means as Gutierrez's polarizing means and analyzing means. Yeh's structure is a functional equivalent substitution of Gutierrez's analyzing means that would be appreciated by one skilled in the art. Also, one skilled in the art would readily recognize that Yeh's structure would work in the reverse direction: if one were to imagine taking Yeh's equal path arrangement and place Gutierrez's linearly polarized laser source at the detector position, Yeh's structure would successfully split the beam into equal parts using the half mirror, rotate the polarization of one beam with the half wave plate, and recombine the beams with the beam splitter. As recited above, Yeh states that the equal path structure allows for near perfect noise suppression through common mode rejection and can be made extremely small if necessary.

Regarding claims 9-10 and 12-15, Gutierrez also does not teach the use of half wave plates, half mirrors, or polarization beam splitters.

With respect to claims 9 and 12, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a half wave plate as taught by Yeh for the simple fact that it is well recognized in the art for use as a simple way to rotate a polarization mode by 90^0. It is fundamental knowledge in the art that orthogonal polarization modes are required in order to minimize crosstalk between the beams during propagation through the sample along the same optical path.

With respect to claims 10 and 13-14, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a half-mirror for the initial splitting (from the laser source) and final recombination (before the detector) of the light beams since the relative intensities of the two beams must be as even as possible for accurate detection of the interference pattern.

With respect to claim 15, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a polarization beam splitter for a light beam splitting means as taught by Yeh. It is the simplest, straightforward method known in the art for distinguishing orthogonal polarization modes. This function is crucial to the functioning of the device since the polarization state of one beam must be rotated to match the other for proper interference at the detector.

Regarding claim 1, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claims 8 and 11 would satisfy the method including:

1) preparing two light beams having the same wavelength of which the plane of polarization are crossed at a given angle,

2) introducing the two light beams into a sample to be measured in anisotropy at the same time,

3) rotating the plane of polarization of one of the two light beams by the given angle so as to correspond to that of the other of the two light beams after passing through the sample,

4) superimposing the two light beams, and

5) observing an interference pattern of the thus obtained superimposed light beam.

With respect to claim 3, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claims 8 and 11 would satisfy the method, including the superposition of the of the two light beams prior to introduction into the sample.

With respect to claim 5, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claims 8 and 11 would satisfy the method, including crossing the beam directions (a.k.a. beam polarization) for introduction into the sample.

In regards to claims 2, 4 and 6, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 9 would satisfy the method, including the provision that the given angle is 90^0.

Response to Amendment/Arguments

The examiner has considered the applicant's arguments; however, they are not persuasive. Further, the amendments that added the functional limitations stating the measurement of anisotropy are not novel over the prior art. The grounds upon which the applicant traverses the rejections appears to claim that the prior art combination is non-obvious because it is non-analogous. It also appears that the functional amendments to the claims are meant to reinforce the argument and place the claims patentably distinct over the prior art.

The examiner wishes to inform the applicant that the inventions are, in fact, analogous, and they also perform the recited functions, as claimed. The inventions disclosed in Yeh, Gutierrez and Martin, and the applicant's disclosure *are all interferometers!* All four devices manipulate orthogonal polarization states in order to determine the anisotropic properties of the medium being tested using interferometry.

The word anisotropy refers to, in this case, material properties of a medium that are not uniform in all directions and orientations. The best examples of such a material, and disclosed in two of the cited prior art references, are birefringent materials. A birefringent material is a material that has two different effects on light traveling through the medium depending upon the polarization state. This is typically due to the arrangement of different crystal planes in a single-crystal material. Two light waves, one vertically polarized and one horizontally polarized, passing through the medium will be phase shifted by different amounts, due to the anisotropic, or birefringent, behavior of the medium. This is commonly measured using interferometry, where the polarization states of one or both emerging light beams are altered such that the polarization states are made to be parallel. This ensures that the two waves will interfere. The phase shift

between them is directly related to the anisotropy, or birefringence, of the medium. The theory is based upon the fact that an isotropic material, or a material whose properties are uniform regardless of orientation, would not induce different phase shifts between the polarization states. Both polarization states would be phase shifted by the same amount. Anisotropic materials cause phase shifts between two differing polarization states.

Gutierrez discloses an interferometer that uses polarizers and analyzers to manipulate the polarization states of light from the light source that passes through the medium. The polarizer splits the beam into superimposed vertical and horizontal polarization states that are entered into the sample. The analyzer recombines the polarization states such that they are parallel. The resulting interference fringes are detected by the detector. In this way, the anisotropic property of the medium, in this case birefringence, is measured.

Yeh discloses an interferometer that measures the anisotropy of a "photoelastic material," which is another type of birefringent medium. The orthogonal polarization states of light from the gain medium are generated in the laser cavity where the birefringent medium is placed. The orthogonally-polarized light waves exit the cavity, where one state is slowed more than the other due to the birefringence of the photoelastic material. The polarization states are split, and one state is rotated by the half-wave plate such that their states are parallel at the beam combiner. The resulting interference pattern at the detector is caused by the anisotropy of the medium.

Yeh takes this one step further, and takes advantage of the photoelastic properties by using it as an accelerometer. The proof mass, "M," is fixed to the photoelastic material and

deforms the material depending upon how fast or slow the vehicle speeds up or slows down. This deformation in the photoelastic material alters the birefringence. The computer takes consecutive interference patterns from the detector and compares the difference between the patterns. This difference is directly related to the change in the birefringence (anisotropy), which is directly proportional to the deformation (strain of the crystal lattice) of the material, which in turn is directly related to the acceleration of the vehicle over the interval of time between the sampled interference patterns.

Martin uses an interferometric arrangement for measuring the polarization mode dispersion (PMD) of a waveguide. This is an anisotropic property whose effects are dependent upon the polarization state of the light passing through the waveguide, and again, as in the other references and the applicant's disclosure, Martin uses precise polarization state control in order to accurately measure the anisotropic properties of the waveguide. The waveguide is not birefringent, which is a special case of anisotropic behavior; however, PMD is induced by the anisotropic properties of the waveguide, which vary as a function of the length of the waveguide and exterior effects.

The applicant's invention operates under the identical principles of all three prior art references explained above. The applicant manipulates orthogonal polarization states of light passing through a medium in order to measure the anisotropy of a material by measuring the phase shift between the polarization states by interferometry. In fact, the separation, rotation,

and recombination of the polarization states in the applicant's invention are identical to Yeh's device, as stated in the rejection.

Regarding the applicant's arguments related to the 35 USC 102 rejection of claim 7 as being anticipated by Martin, it is established above that Martin is analogous art since the device is measuring anisotropy of a sample. The applicant further argues that the sample is not prepared and that the light beam is not introduced into the sample.

First, every sample must be prepared for testing of any kind. Particularly for an optical element, dirt can scatter light, which reduces the intensity at the detector and compromises the accuracy of the interference fringes. Further, routine to "prepare" samples for testing, whether it be a simple cleaning with a brush, or elaborate chemical-based cleaning steps and special mounting procedures onto particular sample holders.

Second, Martin does introduce the light beam into the sample. This is clear. All of the references operate this manner; otherwise, they wouldn't function correctly.

Regarding the applicant's arguments related to the 35 USC 103 rejections of claims 1 and 8 as being unpatentable over Gutierrez and in view of Yeh, it has been established above that the references are analogous art.

The point of departure for which the *prima facia* case of obviousness was made for claims 1 and 8 in the previous Office action lies upon the deficiency of the details of Gutierrez's analyzer structure and the remedy offered by Yeh.

Gutierrez's anisotropic sample is prepared, as all samples for any testing procedure must be, and placed in the apparatus where light is introduced into the sample for anisotropy measurements. The obviousness argument made is based upon taking Yeh's arrangement for manipulating the superimposed, orthogonally polarized light beams after exiting the anisotropic medium, which is identical to the applicant's invention, and substituting it for Gutierrez's analyzer as an advantageous functional equivalent known in the art.

The applicant has not addressed this combination of structure and teachings. More specifically, the applicant argues that Gutierrez does not have a sample that is prepared, nor does the apparatus enter the light beam into the sample. As stated above when referring to the Martin reference, every sample has some sort of required preparation. Further, it is clear in the reference that Gutierrez's apparatus enters superimposed polarized light into the sample.

Further, the applicant argues that Yeh does not teach preparing the sample or entering light into the sample. The sample is prepared, in that the proof mass is attached during the manufacturing steps and placed within the laser cavity. Upon the second point about entering the polarized light beam into the sample, the examiner agrees with the applicant. Though light is entered into the sample from the gain medium, the light passes through many times and is polarized during the process by the mirrors that form the laser cavity. Therefore, the polarized light is not formally entered into the sample as a separate step.

However, as outlined above and stated in the rejection, Yeh is not being relied upon for these teachings. Gutierrez is not deficient in either limitation. Yeh's anisotropy analyzing interferometer manipulates the light exiting the sample identically to the applicant's invention, and it is relied upon for that structural teaching.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas R Artman whose telephone number is (703) 305-0203. The examiner can normally be reached on 8am - 5:30pm Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1782.

Thomas R. Artman
Patent Examiner
June 5, 2003

TRA

David Bruce

DAVID V. BRUCE
PRIMARY EXAMINER